INTELLIGENT CONFIGURATION SERVER

This application is a continuation of co-pending application 09/320,062 which is a continuation in-part of co-pending application serial number 09/048,917 filed March 26, 1998 which is a continuation of Patent 5,734,705 which issued March 3,1998.

Background of the Invention:

This invention relates generally to a Private Branch Exchange (PBX) and more particularly to an intelligent configuration server that automatically initializes a call accounting system which generates reports from PBX call detail record output data.

Phone calls from a PBX system are tracked and reported using call accounting programs. The accounting program reads Call Detail Recording (CDR) messages alternatively referred to as Station Message Detail Recording (SMDR) messages which are output from the PBX. A PBX output port, usually comprising an RS-232 receptacle, outputs the CDR messages. The accounting program is loaded onto a personal computer (PC) and the PC is connected directly into the RS-232 receptacle on the PBX or through an inline intermediate storage device, or via a dial-up modem.

The CDR messages output from the PBX output port contain information about each telephone call processed by the PBX. The call accounting program

reformats the CDR messages into sophisticated tracking reports. For example, the accounting program can reformat the CDR messages into lists identifying telephone calls according to business department, telephone extension or by time of day. Different PBX manufacturers and even different PBX models from the same manufacturer may generate different CDR message formats. Therefore, in order to accurately decipher CDR messages, accounting programs must be configured specifically for the PBX type.

A rate table is a database that contains the cost of calls, for example, referenced to different parameters such as country codes, city codes, area codes and exchange based on the number dialed plus certain time-of-day considerations. Typically, rate tables are manually loaded into the PC running the accounting program via floppy disk. The rate tables are periodically updated, again via floppy disk, to reflect changes in phone tariffs.

Typically, call accounting programs require a local PBX technician to identify the PBX manufacturer and PBX model number as part of the sales order or part of the installation procedure. The call accounting program is either hard-coded to support the specific PBX type or shipped with pre-configured tables that support known PBX types. If the PBX type and model number are unknown to the local PBX technician or if the PBX type is not one of the PBX types hard-coded into the call accounting software, the accounting program cannot generate reports from the PBX.

Rate tables are typically manually loaded into the PC running the accounting program. Rate tables vary according to location of the PBX (area code and exchange) or vary according to country codes and city codes. Therefore, a different rate table is required for each accounting program or for each site configuration within the program which is operating in a different Local Exchange Carrier's rate center. There are over 15,000 rate centers in the U.S. Presently, the different rate tables are copied onto floppy disks and sent to each local PC software operator. The software operator then manually copies the contents of the floppy disk into the PC running the accounting program. Tariffs and numbering plans for telephone calls frequently change. Thus, rate tables must be constantly updated in each PBX accounting program. Manually tracking the appropriate rate table for each accounting program and then periodically mailing updated rate tables to each customer is time-consuming, expensive and prone to mishandling resulting in magnetic media damage.

Accordingly, a need remains for automatically reconfiguring an accounting program to run with different PBX types and CDR software package updates on a PBX, automatically updating program rate tables for each accounting program and increasing security for proprietary software used in the accounting program.

Summary of the Invention:

An intelligent configuration server analyzes sample CDR messages from different PBXs. A sample CDR message from a PBX is transmitted to the

central configuration server via a standard dial-up modem. The configuration server determines the actual PBX type by comparing the sample CDR message with known CDR message streams previously stored in server memory.

If the PBX type is identified, a corresponding PBX interface file is transmitted from the configuration server back to a local PC connected to the PBX. The PBX interface file is used by the PC accounting program to identify the correct format for CDR messages output from the PBX. The accounting program can then correctly interpret the CDR messages output from the PBX into call reports. If a sample set of CDR messages is not recognized by the configuration server, a message is transmitted to the local PC software operator and to a customer service operator maintaining the configuration server.

The configuration server downloads rate tables via modem to the local PBX. The PC call accounting software automatically sends identification (ID) and location data to the configuration server. The ID and location data includes the name, address, area code and exchange for the local PBX. The configuration server uses the ID and location data to identify the appropriate rate table for the local PBX. The rate table is then automatically downloaded from the configuration server to the local PC for use with the accounting program.

Each remote PC software operator can manually request rate table updates at any time from the configuration server or schedule the downloads to take place

automatically on a periodic basis. Thus, operator interaction is not required to maintain up-to-date tariffs in customers' call accounting programs.

CDR message analysis and rate table assembly is performed at one central configuration server location. Security of proprietary CDR message analysis software is increased since analysis software is not distributed to end users. The time and cost of distributing, tracking and updating rate tables for each customer is decreased since rate tables are automatically sent via modem from a central server. Repeated end-user training due to personnel changes is reduced and system accuracy improved through the automation of this process.

The foregoing and other objects, features and advantages of the invention will become more readily apparent from the following detailed description of a preferred embodiment of the invention which proceeds with reference to the accompanying drawings.

Brief Description of Drawings:

FIG. 1 is a diagram of an intelligent configuration system according to the invention.

FIG. 2 is a detailed diagram of the intelligent configura-tion system shown in FIG. 1.

FIG. 3 is a step diagram showing a method for installing and operating the intelligent configuration system shown in FIG. 1.

Detailed Description of the Invention:

FIG. 1 is a schematic diagram of an intelligent configuration system 12 according to the invention. A configuration server 14 is located at a central system support location and is coupled to a modem 16. One example of a configuration server 14 is a PC workstation attached to a Novell Netware 3.12 version server. However, any computer capable of receiving, sending and processing data in a manner described below can be utilized. For example, in another embodiment of the invention, a stand-alone call accounting system is used independently of the PC environment and comprises special hardware including a processor and memory for storing call records and rate tables, etc.

PBXs 22A, 22B and 22C each support a separate telephone network at different locations and are any of a large number of commercially available PBX systems well-known to those skilled in the industry. Each PBX 22A-22C is coupled to a local personal computer (PC) 20A-20C, respectively. Modems 18AB18C are connected to each local PC 20A-20C, respectively, and provide electronic data communication between the local PCs 20A-20C and configuration server 14 via modem 16.

The transmission of rate tables and configuration data between the configuration

server and the host PC can be conducted by means other than an analog modem. In one embodiment, data is transmitted over a digital network, such as ISDN through a terminal adapter.

FIG. 2 is a detailed diagram of both the configuration server 14 and one of the local PCs 20A shown in FIG. 1. Local PCs 20B and 20C operate in a similar manner to PC 20A described below. The configuration server 14 includes a processor 15 connected to a memory 17. Memory 17 contains three databases. A PBX database includes PBX interface files containing information on different PBX types supported by the intelligent configuration system 12. For example, the PBX interface files may describe distinguishing characteristics of CDR message strings output by particular PBX types and identifies the appropriate translation routine used by the accounting program to interpret and price the CDR messages.

A rate table database contains rate tables for different telephone parameters such as area codes and exchanges or country codes and city codes instead of area codes and exchanges and multiple service providers. The rate tables contain tariff information for local and long distance telephone calls made through different telephone companies according to the day of the week and the time of the day. A customer database contains customer files for each accounting program supported by the intelligent configuration system 12.

Local PC 20A includes a processor 19 coupled to a memory 21. The memory 21 stores the accounting program, a rate table corresponding with the local PBX area code, a PBX interface file and ID and location data. The accounting program is used by processor 19 to generate telephone accounting reports and the rate table is used by the accounting program for cost analysis and traffic engineering analysis. The PBX interface file is used by the accounting program to identify the CDR message format output from the PBX. The ID and location data are transmitted to the configuration server 14 for referencing the appropriate customer file in memory 17.

The processor 19 receives ID and location data through a keyboard input 26 or automatically from the installation floppy diskette, and CDR messages from PBX 22A through an RS-232 input 24. The processor 19 transmits via modem 18A (FIG. 1) the PBX ID and location data and sample CDR messages 23 to processor 15. Processor 15 uses the CDR and location data 23 to identify the correct PBX interface file and rate table 25 for transmitting back to processor 18.

Referring to FIG. 3, the intelligent configuration system 12 operates in the following manner. For simplicity, operation is referenced only to local PC 20A. Local PCs 20B and 20C operate in a similar manner. Local PC 20A is connected through RS-232 port 24 (FIG. 2) to the PBX 22A in step 34 and local PC 20A actuated in step 36. A PBX operator in step 38 inputs ID and location

data via the keyboard input 26 (FIG. 2) into local PC 20A. Step 40 sends the ID and location data to the configuration server 14 via modems 18A and 16 (FIG. 1).

In step 42, the local PC 20A reads a set of sample CDR messages from the PBX 22A and step 44 transfers the sample CDR messages to configuration server 14. Step 46 analyzes the sample CDR messages in the configuration server 14 to determine the PBX type. The configuration server 14 matches the sample CDR messages sent from local PC 20A by identifying unique message characteristics described in a PBX description file stored in memory 17 (FIG. 2) for known PBX types.

The example below shows sample SMDR records output from different PBX units.

EXAMPLE #1

Sample SMDR Records:

08/03	07:59	0000:01:34	2630		121233380402542630	X143		
08/03	07:59	0000:02:02	2502		161096233332542502	X142		
08/03	08:01	0000:00:14	X124	004	4506 1111		3101	
08/03	08:01	0000:00:30	4801		52010732544801	X146		
08/03	08:02	0000:00:18	4352		140439756432544352	X147		
08/03	08:03	0000:00:14	X122	004	4506 1111		2208	
08/03	08:02	0000:02:52		X123	004	1111		3102
08/03	08:02	0000:02:20		X124	004	1111		3103
08/03	08:05	0000:00:10		2630		130554669082542630	X148	
08/03	08:05	0000:00:21		X124	004	1111		2101
08/03	08:05	0000:00:07		X147	***	9	T	
08/03	08:05	0000:00:14		X124	005	4506 1111		2103
08/03	08:06	0000:00:11		4352		18006944997		T4
08/03	08:05	0000:01:08		4722		18008762722		T3
08/03	08:05	0000:01:12		X148	004	1111		2104
08/03	08:06	0000:00:30		X124	005	1111		3102
08/03	08:04	0000:02:44		X209	001	2937		2937
08/03	08:04	0000 02:51		4353		2732937	T1	
08/03	08:07	0000:00:05		X205	023	2958	T 3364	

PBX Analysis Match:

Switch Type		mitel
Description		MITEL SX100/SX200 - MITL9105/9110-097-451NA-AUG81
Call Type	Outgoing	
Record Type		T|X|A 62..62
Date		mm/dd 2..6
Time		hh:mm 8..12
Duration	hh:mm:ss	15.22

Switch Type		mitel
Description		MITEL SX100/SX200 - MITL9105/9110-097-451NA-AUG81
Call Type	Incoming	
Record Type		T|X|A 24..24
Date		mm/dd 2..6
Time		hh:mm 8..12
Duration	hh:mm:ss	15.22

EXAMPLE #2

Sample SMDR Records:

```
N 059 00 T004001 DN7309                          09/15 08:20 00:05:48
            0000   0000

D 060 00 T004001 DN7309                          09/15 08:26 00:05:48

S 061 00 T004001 DN8091                          09/15 08:26 00:00:06
            0000   0000

N 062 00 DN7200  T002008 016.0.00.10 09/15 08:26 00:00:40 A 800215104166242
      0000   0000

N 063 00 T004002 DN7133  014.0.00.14 09/15 08:27 00:00:02
      0000   0000

N 064 00 DN7394  T002007              09/15 08:26 00:00:54 A 80214042307088
            0000   0000

N 065 00 DN7262  T002009 023.0.00.02 09/15 08:26 00:03:02 A 800212092231660
      0000   0000
```

PBX Analysis Match:

Switch Type		nt_tenan
Description		NT MERIDIAN 1 -- MULTI-TENANT CODE
Call Type	Incoming	
Record Type		(N|S|E)&T 1..1&10..10
Date		mm/dd 38..42
Time		hh:mm 44..48
Duration	hh:mm:ss 50..57	

Switch Type		nt_tenan
Description		NT MERIDIAN 1 -- MULTI-TENANT CODE
Call Type	Outgoing	
Record Type		(N|S|E)&T 1..1&18..18
Date		mm/dd 38..42
Time		hh:mm 44..48
Duration	hh:mm:ss 50..57	
Digits	(A y*) 59..80	

Switch Type		nt_tenan
Description		NT MERIDIAN 1 -- MULTI-TENANT CODE
Call Type	TENANT	
Record Type		00&00 10.11&18..19

EXAMPLE #3

Sample SMDR Records:

```
0952 0001 7   9  83                    886819     722     6 0          15
0952 0002 7   9  83                 18002359216   702     7 0          03
0952 0017 0                            785     301
0952 0021 9                            799      83     7 0 02
0952 0045 7   9  83                   7543788   706     6 0          08
0953 0004 7   9  80                0118525294118#  371     7 0          14
0953 0062 9                            799      80     7 0 06
0953 0000 7   9  83                   8886819   722     6 0          09
0954 0188 9                            788      84     7 0 04
0954 0001 0                            740     302
0954 0011 9                            799      83     7 0 02
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0954 0005 0                                  771   302
0954 0015 7  9  83                          5965433  705          6 0          12
0954 0020 9                                   754    84          7 0 05
0955 0004 7  9  80                  0118525294118#   371          7 0          12
0955 0067 7  9  83                        5719330   343          6 0          07
0956 0002 7  9  83                        2778194   310          6 0          15
0956 0005 7  9  83                        2700535   771          7 0          14
0956 0038 7  9  83                        6680264   312          7 0          10
0956 0034 9                                   799    80          7 0 16
0956 0001 0                                   312   301
0957 0001 7  9  83                        2767255   771          7 0          11
0957 0015 9                                   799    83          7 0 02
0957 0009 7  9  83                     3588000799   792          7 0          13
0957 0007 7  9  83                            411   788          6 0          12
0957 0004 7  9  80                  0118525294118#   371          7 0          10
0957 0003 9                                   794    84          7 0 07
```

PBX Analysis Match:

```
Switch Type                 att75v3
Description                 AT&T SYS 75 R1V3
Call Type          Incoming
Record Type                 9 11..11
Date
Time                        hhmm 1..4
Duration           hmmt 6..9
Extension                   x+ 32..35

Switch Type                 att75v3
Description                 AT&T SYS 75 R1V3
Call Type          Outgoing
Record Type                 1|7|A|C 11.11
Date
Time                        hhmm 1..4
Duration           hmmt 6..9
Extension                   x+ 38..41
Digits             y+ 21..35
```

The configuration server 14 recognizes PBX types by matching the characteristics, such as record format, (other options are possible for other PBXs) with previously stored samples. As shown in the examples above, each of the three PBX units outputs a different SMDR record format. The configuration server 14 can accordingly identify the SMDR report type according to the specific format characteristics.

Each sample contains a default of 4000 characters or approximately 45 call records, depending on the CDR record length. A predetermined number of

matches to the same PBX type is required before a match is considered complete. Each CDR message in the sample uploaded to the configuration server is evaluated against all stored PBX types.

Step 48 downloads the appropriate PBX interface file for the identified PBX type to local PC 20A. Failure to recognize a PBX type results in the configuration server 14 sending a message to local PC 20A as well as to customer service personnel operating the configuration server 14. The pattern matching program used by the configuration server 14 can be modified by a technician to add or change PBX recognition criteria. The sample CDR messages received from local PC 20A are preserved in memory on the configuration server 14 as PC files identified by the customer ID.

Step 50 downloads a rate table from the configuration server 14 to local PC 20A. The configuration server 14 uses the ID and location data (e.g., area code) transmitted in step 40 to locate the appropriate rate table for PBX 22A. Step 52 uses the downloaded PBX interface file and the downloaded rate table to generate accounting reports from the CDR messages output from PBX 22A.

The PBX operator can manually request rate table updates at any time or schedule the downloads to take place on a periodic basis. Decision step 54 monitors either a manual keyboard request or a preprogrammed periodic request

for updating the rate table. When a manual or an automatic update request is made by the local PC 20A, decision step 54 jumps to step 50. The configuration server 14 then searches the customer database for the name of the rate table file of the local PC requesting the update. The configuration server locates the appropriate rate table and then sends the rate table to local PC 20A. Subsequent telephone reports generated in step 52 use the updated rate table transmitted in step 50.

Each session between the local PC 20A to the configuration server 14 is initiated with a unique serial number. The configuration server 14 verifies the serial number and the command in the customer database. If the serial number is not in the database or has already been registered, communication between the local PC 20A and configuration server 14 is terminated. Thus, the configuration server 14, without operator intervention, constantly monitors which accounting programs are initialized and when each accounting program requests a rate table update.

It should be noted that other embodiments of the system also come within the scope of the invention. For example, the entire system including the local PC and the configuration server can be contained within a single stand-alone PC which stores sample SMDR reports, rate tables, etc., performs the functions of configuration server 14 and local PC 20.

Many other alternative embodiments of the invention are possible. For example, alternative embodiments of the invention can include systems wherein the PBX system shown herein is replaced by a different communication system that serves to connect two endpoints for voice or data communications and messaging. For example the PBX system shown herein can be replaces by other communication systems such as WAN (Wide Area Network) access, Internet web access, by e-mail access, video conferencing, fax, chat messaging, ftp sessions, telnet sessions, Voice over IP (VoIP), Fax over IP, etc.

In still other alternative embodiments the CDR messages shown herein can be replaced by other messaging systems that serve as audit trails to communications and message transactions including traffic/usage messages from firewalls, routers, bridges, gateways, LAN-PBX, IP-PBX, PC-PBX, HTTP servers, SMTP servers or VPN devices. In such alternative embodiments, such other messaging systems are equivalent to the CDR messaging system shown herein.

In still other alternative embodiments of the invention, the rate tables shown herein can be replaced by other criteria for billing based on network usage including IP packet count, byte or octet count, hours, minutes, seconds, sub-second measurements. In such alternative embodiments, such alternative criteria for billing are equivalent to the rate tables shown herein.

In still other alternative embodiments, other communication devices in addition to modems can be used to establish a connection to the Configuration Server. Such alternative communication devices include, TCP/IP sockets, ftp sessions, telnet sessions.

Having described and illustrated the principles of the invention in a preferred embodiment thereof, it should be apparent that the invention can be modified in arrangement and detail without departing from such principles. We claim all modifications and variation coming within the spirit and scope of the following claims. For example, the invention could be used in an environment where one PC monitors the performance of many PBX's. In such a situation, the PC could have an internal buffer that stores CDX messages until retrieved by the PC.